ED03-OWI-001
Revision: A
EFFECTIVE DATE: September 2, 2005

ORGANIZATIONAL ISSUANCE

ED03

MSFC ENGINEERING DOCUMENTATION CHECKING

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		3/15/05	Document converted from ED43-017 due to Center Reorganization.
Revision	A	9/2/05	Corrected form number from ED03-OWI-004 to ED03-OWI-001 and revised the Records section to make the records disposition instructions more specific.

1. PURPOSE

The purpose of this OI is to provide clear instructions for performing MSFC engineering documentation checking.

2. APPLICABILITY

This OI is applicable to personnel performing MSFC engineering documentation checking tasks.

3. APPLICABLE DOCUMENTS.

SPECIFICATIONS:

MSFC

MSFC-SPEC-548	**Vacuum Bake Electrical Connector Specification**
MSFC-SPEC-684	**Vacuum Bake Cables Specification**
MSFC-SPEC-708	**Specification for Identification Marker for Space Systems Electrical Harnesses**

NASA

JSC-SN-0005	**NASA Specification Contamination Control Requirements for the Space Shuttle Program**

OTHER SPECIFICATIONS

A-A-52082	**Tape, Lacing and Tying, TFE-Flourocarbon**
SAE-AMS-DTL-23053/8	**Insulation sleeving, Electrical Heat Shrinkable**

STANDARDS:

MSFC

MSFC-STD-555	**MSFC Engineering Documentation Standard**
MSFC-STD-2903	**MSFC Tailoring Guide for NASA-STD-8739.3, Soldered Electrical Connections**
MSFC-STD-2904	**MSFC Tailoring Guide for NASA-STD-8739.2, Workmanship Standard for Surface Mount Technology**

APPLICABLE DOCUMENTS: (CONTINUED)

STANDARDS

MSFC

MSFC-STD-2905	**MSFC Tailoring Guide for NASA-STD-8739.4, Crimping Interconnecting Cable Harness & Wiring**
MSFC-STD-2906	**MSFC Tailoring Guide for NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electrical Assemblies**

OTHER DOCUMENTS:

MSFC

MPR 7120.2	**Multiprogram/Project Common-use Documentation**
MWI 7120.4	**Documentation Preparation, Programs/Projects**
ED03-FORM-001	**MSFC Engineering Checking Log**

NASA

NPR 1441.1	**NASA Records Retention Schedules**

4. Definitions

None

5. INSTRUCTIONS

5.1 MSFC Engineering Drawing Checking

Personnel shall perform checking of engineering drawings for compliance with MSFC-STD-555 prepared for in-house design/development projects. This function shall also be specifically directed by ED03 management. The engineering drawing checking function shall include the following:

a. Review for conformance with the applicable NASA, Military, and Industry documentation (standards, practices, handbooks, specifications, directives, and manuals) with respect to format and technical details.

(1) Format general areas of review including the title block, revision block note numbering and location, letter size, heavy clear lines and arrows, visual appearance, and quality of the drawing.

(2) Technical details include correct notes, appropriate and adequate specifications, adequate projected views, sections, tolerance fit checks of detail and assembly parts, terminal numbers on electrical schematics, cable design, and component reference designators.

b. Consult with design organization personnel as follows:

(1) Prior to the beginning of the design and development portion of the implementation phase of a project, to specify how much time would be needed and to relay the guidelines under which complete checking (normal process) is to be conducted. The normal process guidelines require all drawings, parts lists, and associated data to be submitted by engineering design as a complete package to accomplish the checking of an item or assembly. Any backup data to support the checker shall be returned to the requester. The checker shall enter the documentation in the MSFC Engineering Checking Log, form no. ED03-FORM-001. The checker and the requester shall establish the type of checking to be performed and a due date. The checker shall initial the agreement in the checking log. The requester shall initial the checking log or send checking an e-mail verifying the type of check and a due date. If the requester responds by e-mail, the checker shall enter an “E” in the checking log, “Requester Initial or E-mail” Column and file the e-mail in the checking e-mail book.

(2) During the design and development process when the normal checking process time is not available due to actual or projected project constraints, dialog between checking and the requester is necessary to formulate what can be done in the limited time available. The checker shall enter the documentation into the MSFC Engineering Checking Log, form no. ED03-FORM-001. The checker shall initial the agreement in the checking log. The requester will initial the checking log or send checking an e-mail verifying the type of check and a due date. If the requester responds by e-mail, the checker shall enter an “E” in the checking log, “Requester Initial or E-mail” column and file the e-mail in the checking e-mail book.

(3) When the design process results in piece-meal submittal of drawings; form, fit, function, and tolerance fit checks are not possible. The Checker shall enter the documentation into the MSFC Engineering Checking Log, form no. ED03-FORM-001. The checker and the requester shall establish the type of checking to be performed and a due date. The checker shall initial the agreement in the checking log. The requester shall initial the checking log or send checking an e-mail verifying the type of check and a due date. If the requester responds by e-mail, the checker shall enter an “E” in the checking log, “Requester Initial or E-mail” column and file the e-mail in the checking e-mail book.

(4) When a package is complete but time is limited the process in (3) above shall be used.

(5) Provide guidance on the preferred techniques of document or drawing presentation.

5.2 Review of book form documents

Review of book form documents such as specifications, standards, requirements, handbooks, procedures, etc., which will be released by the MSFC ICMS for conformance to the release system standard, MSFC-STD-555. As required by MPR 7120.2, Multiprogram/Project documents shall be reviewed for conformance with MWI 7120.4. The checker shall enter the documentation into the MSFC Engineering Checking Log, form no. ED03-FORM-001. The checker and the requester shall establish the type of checking to be performed and a due date. The checker shall initial the agreement in the checking log. The requester shall initial the checking log or send checking an e-mail verifying the type of check and a due date. If the requester responds by e-mail, the checker shall enter an "E" in the checking log "Requester Initial of E-mail" Column and file the e-mail in the checking e-mail book.

5.3 Checking Process

The Checking process is shown in the checking flow diagram and is detailed as follows:

a. Checking receives a documentation package and determines the type of checking in accordance with paragraph 5.1 or 5.2. The drawing/document number is entered into the MSFC Engineering Checking Log, form no. ED03-FORM-001.

b. The package is checked in accordance with this OI and the applicable documents. The copies are stamped as "Check prints" and initialed by the checker with the approved information marked in yellow and the recommended changes marked in red. Suggested changes that are not mandatory for release shall be marked with a different color and identified as "suggested changes only."

c. The designer is contacted to pick up the package and it is logged out of the checking log book by date.

d. The checker shall explain each recommended change if necessary, provide references, and satisfy the requester for each change marked in red on the check prints.

e. The requester incorporates the recommend changes and returns the package to checking.

f. Checking re-enters the package in the checking log book by date and back-checks to ensure the incorporation of the recommended changes. If the package is correct, the checker applies the checking approval stamp, checkers initials, date and logs out of the checking log book by date.

g. The package is returned to the requester. If the package is stamped and signed by checking, the requester continues the process through the release system. If the package was not signed by checking, the requester shall incorporate the changes and return the package to checking

h. Checking shall recheck and sign the package if correct and return it to the requester. The requester continues to process the package through the release system.

5.4 Producibility Checklist.

The Producibility Checklist, Appendix A, shall be utilized by the Producibility Checker to review engineering drawings, engineering parts list, and engineering orders.

6. NOTES

NONE

7. SAFETY PRECAUTIONS AND WARNING NOTES

NONE

8. APPENDICES, DATA, REPORTS, AND FORMS

Appendix A, Producibility Checklist

9. RECORDS

Each drawing checker or producibility checker shall maintain the records for the documentation/drawing packages they check in accordance with NPR 1441.1, NASA Record Retention Schedules (NRRS), per the following instructions. MSFC Engineering Checking Log, ED03-FORM-001, and e-mails associated with the log shall be maintained as temporary records in accordance with NRRS 1/78/C - destroy or delete when 2 years old, or 2 years after the date of the latest entry, whichever is applicable. The check prints and producibility checklists shall be maintained as temporary records in accordance with NRRS 1/78/D – destroy when 1 year old or when no longer needed, whichever is sooner. At a minimum, Checkers will retain the check prints and checklists until the corrected package is verified against the comments provided in the check prints/checklists and the checking stamp or signature is applied to the corrected package.

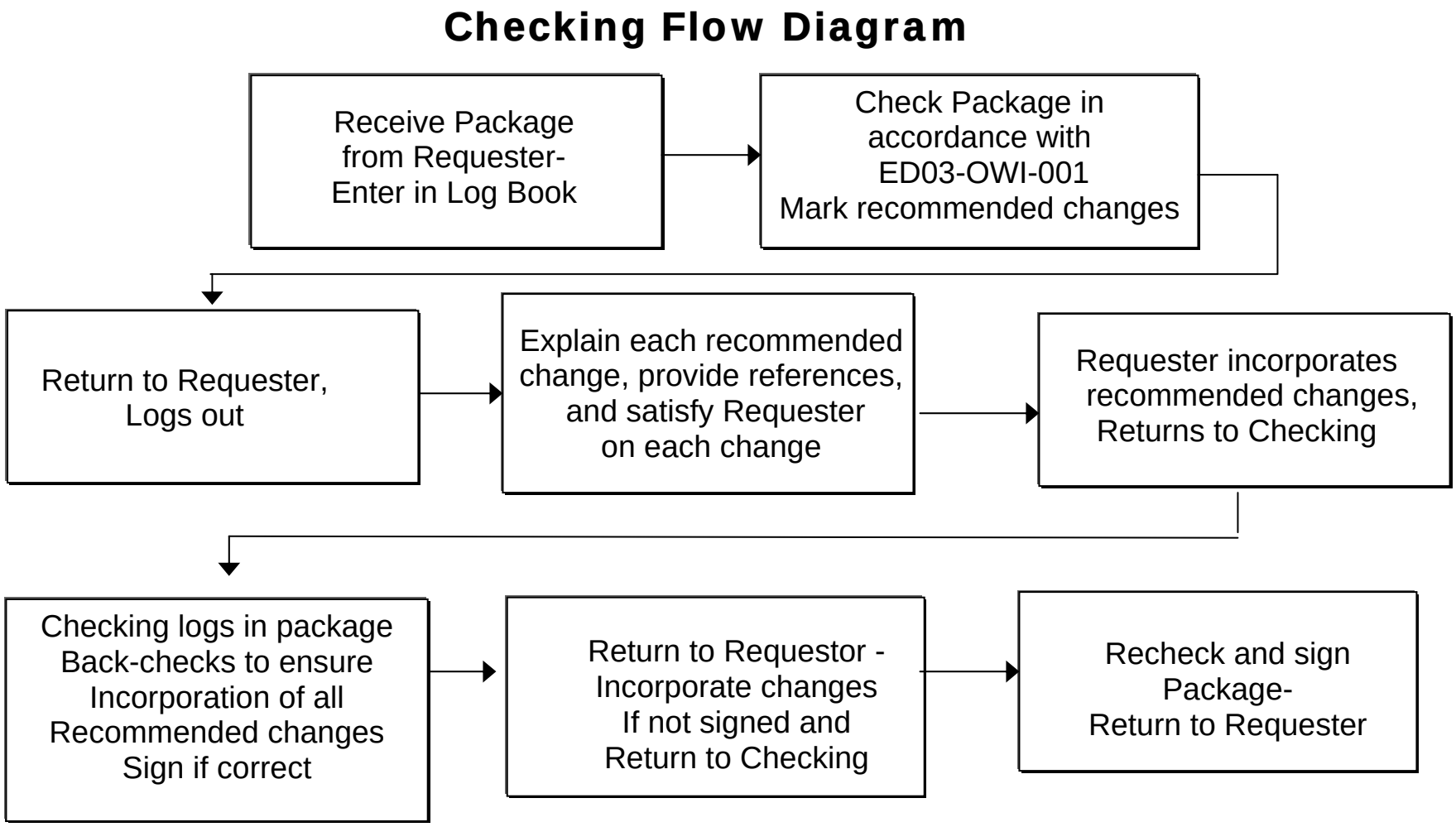
10. TOOLS, EQUIPMENT, AND MATERIALS

NONE

11. PERSONNEL TRAINING AND CERTIFICATION

NONE

12. FLOW DIAGRAM



APPENDIX A

ITEM	**REQUIREMENTS**
GENERAL	
Standards	Assure correct and current callout of Standards
Clarity	Check drawings and engineering parts lists (EPL's) to ensure they are clearly written and drawn, and subject to only one interpretation.
Specification callouts	Ensure parts, materials, and processes are indicated on the drawing and/or parts list where appropriate drawing notes or the body of the drawing detail the design specification. Ensure, when applicable, that material and process specification call-outs include type and class.
Drawing Notes	Assure all flagged notes are indicated in the body of the drawing and have leaders to their correct destination.
Find Numbers	Assure that all find numbers bubbled in the body of the drawing have leaders to their correct destination.
Drawing revisions	Assure all drawing revisions include the description of the change. Verify the change has been incorporated into the revised drawing which is correctly dated.
Traceability	Assure piece part/assembly serialization identification requirements are specified on the drawing.
Identification	Ensure all parts on the engineering parts list are identified by a part number, description, and quantity. Ensure that reference designators used on the assembly drawing are used consistently on all associated drawings and related lists.
Marking	Ensure all marking is shown in the body of the drawing and documented in the drawing notes. Ensure part marking materials are specified. Verify area is large enough to accommodate marking as specified.
Electrostatic Discharge	Assure that Electrostatic Discharge (ESD) awareness is noted on the drawings where applicable (PWA and assemblies containing static sensitive devices). Assure that ESD awareness symbols and/or Caution notes are marked on hardware that is susceptible to damage.
Torque value Of locking features	Assure when two locking features are present that with run down torque there shall be no evidence if torque being to high and allowing for too much pressure on parts (plastic parts).

ELECTRICAL	
PWA	**(Printed Wiring Assembly)**
General	Ensure that for printed wiring assemblies (PWA's) a drill and trim drawing, schematic, and an assembly drawing are provided.
Soldering	Solder shall be specified per MSFC-STD-2903/2904 or a project approved equivalent.
Silkscreen	Assure that silkscreen on the drill and trim drawing matches the printed wiring assembly drawing.
Reference designator	Ensure that reference designators specified on the drawing match the EPL and that traces or other parts of the drawing do not obscure them. Verify that the quantity called out on the EPL and the quantity of reference designators match.
Polarity	Ensure that polarity/pin 1 orientation is specified where applicable. If polarity is not applicable to a specific part (ex: diode and trimpots) a drawing note shall state polarity does not apply.
Torque values	Assure that torque values are noted where applicable.
Hardware	Verify the stack up measurement against the length of screw called out. Verify that screws and nuts have the same kind of thread (fine, coarse) and are the same size (2-56, 4-40). Shims used as spacers shall be of a fiberglass material to reduce the risk of shorting.
Detail Views	Assure detail section in the body of drawing has a detail view shown on drawing. Verify correct reference designators and find numbers are called out in detail views. Verify parts that require a height off the board are shown in a detail view. Assure that views shown and wording in drawing notes match.
Sleeving	Ensure jumpers without insulation are sleeved using a shrinkable sleeving per SAE-AMS-DTL-23053/8 Ensure that solder connections requiring to be sleeved use SAE- AMS-DTL-23053/8.
Cabling and wiring (pigtails)	Cable fabrication and crimping shall be per MSFC-STD-2905 or project approved equivalent. Ensure that wires are properly identified by size and specification. Assure that the length of the pigtail is shown from the edge of the board to the end of wire and/or face of connector. Ensure the direction that wires are to exit from the board are shown. Verify wire size to the diameter of plated thru hole in the board. Ensure that wires installed on printed wiring assembly connectors are installed on the circuit side of board. Assure that silver wire is not used (red plague control).
Staking	Staking shall be per MSFC-STD-2906. Ensure that type and location of staking material is specified. Glass bodied parts shall be sleeved prior to staking. All tantalum capacitors shall be staked.
Conformal coating	Conformal coating shall be per MSFC-STD-2906. Ensure that drawing notes include areas to be masked, mix ratio, bakeout time and temperature. Verify that areas of masking are dimensioned and noted near side and far side where needed.

ASSEMBLIES	
Cabling and wiring	Cable fabrication and crimping shall be per MSFC-STD-2905 or project approved equivalent. Ensure that wires are properly identified by size and specifications. Ensure shields on twisted shielded wires are shown terminated or floating and the floating shields shall be covered with sleeving.
Torque values	Assure that torque values are noted where applicable.
Hardware	Verify the stack up measurement against the length of screw called out. Verify that screws and nuts have the same kind of thread (fine, coarse) and are the same size (2-56, 4-40). Ensure that the hole size in mechanical parts is large enough to accommodate the screw size called out. Braycote lubricant is recommended for ease of assembly.
Lockwire	Ensure location is shown and size is called out when required.
Schematic	Ensure wiring is point to point and size is shown where required.
Cleanliness	Cleanliness shall be per JSC-SN-0005.

CABLES	
Crimping, Cabling, Wiring and Testing	Cable fabrication, crimping and testing shall be per MSFC-STD-2905 or project approved equivalent. Ensure the drawing requires cable and harness continuity, isolation resistance, and dielectric withstanding voltage testing.
Cleanliness	Cleanliness shall be per JSC-SN-0005.
Connector bakeout	Vacuum baking of connectors and accessories shall be per MSFC-SPEC-548. Omit part marking.
Cable bakeout	Vacuum baking of cables shall be per MSFC-SPEC-684 .
Twisting and securing	When twisting of a cable is called out assure that the number of twist per foot is noted. Ensure that drawings state to lace cable using lacing tape (A-A-52082) or spot tie cable using lacing tape and/or tie wraps. Knots shall be staked using a staking compound.
Pictorial views	Ensure that the pictorial views shown and wording in drawing notes match.
Reference designator	Ensure that reference designators specified on the drawing match the EPL. Verify that the quantity called out on the EPL and the quantity of reference designators match.
Wire	Ensure that wires are properly identified by size, and specification. Verify wire call out on EPL and wire list and/or pictorial views match. Verify wire list against the number of contacts in a connector verses the number of seal plugs needed. Ensure that wire is called out for daisy chaining. Assure that silver plated is not used (red plague control).
Solder cup connectors	Solder cup terminations shall be isolated using shrink sleeving per SAE-AMS-DTL-23053/8.
Braid termination	Ensure that braid is shown terminated by one of the following methods: daisy chain, floating, backshell termination ring and/or banding clamp. Floating shield shall be covered using shrink sleeving per SAE-AMS-DTL-23053/8.
Sealing plugs	Ensure that drawing states whether the use of seal plugs and unused contacts are required.
Torque values	Ensure that torque values are specific to the connector.
Cable Length	Assure that the length of cables are measured from face to face of connector.
Connector	Assure that contacts are supplied with connector or are called out on EPL as a separate F/N.
Backshell	Assure that backshell size and connector size are compatible (11 conn. shall be 11 backshell). Assure backshell entry and strain relief clamp are large enough to accommodate cable bundle size and that the braid termination ring is large enough to carry braid verses the need to daisy chain braid. Assure that the cable bundle is wrapped a minimum of turns at strain relief clamp using fiberglass tape.
Strain relief screws	Assure that strain relief screws are trimmed and deburred to a maximum number of threads protruding and encapsulated with a type of staking compound.
Labels	Assure that labels are per MSFC-SPEC-708. Assure that labeling information and location of label is noted on drawing.
Connector clocking	Assure that clocking views shown on drawing are clear and subject to only interpretation.
Retention test	For connector contacts that use retention clips or tines assure that retention test are specified for contact seating verification per MSFC-STD-2905.

MECHANICAL	
Material	Ensure that the material and traceability level is specified.
Surface Finish	Ensure that a surface finish is defined. Break sharp edges and deburr.
Radius	Ensure that radius is noted where applicable.
Dimension and Tolerance	Assure that dimensions and tolerances are specified where needed. Ensure that three place decimals are not noted when two places is sufficient.
Inserts	Assure that insert callout is consistent with specification reference.
Fastener Installation	Ensure fastener installation requirements are specified.
Cleanliness	Ensure that cleanliness is per JSC-SN-0005.
Surface coating	Assure that surface coatings are defined and the correct specification is noted (chemical film, anodize).
Hole Dimensions	Ensure that holes around the edges of a plate are distanced a minimum of two times the bolt diameter from the edge of the plate.